

EXHIBIT A



**KOMITE NASIONAL KESELAMATAN TRANSPORTASI
REPUBLIC OF INDONESIA**

PRELIMINARY

KNKT.21.01.01.04

Aircraft Accident Investigation Report

PT. Sriwijaya Air

Boeing 737-500; PK-CLC

Near Kepulauan Seribu, Jakarta

Republic of Indonesia

9 January 2021

2021

This Preliminary Report was published by the Komite Nasional Keselamatan Transportasi (KNKT), Transportation Building, 3rd Floor, Jalan Medan Merdeka Timur No. 5 Jakarta 10110, Indonesia.

The report is based upon the initial investigation carried out by the KNKT in accordance with Annex 13 to the Convention on International Civil Aviation Organization, the Indonesian Aviation Act (UU No. 1/2009) and Government Regulation (PP No. 62/2013).

The preliminary report consists of factual information collected until the preliminary report published. This report will not include analysis and conclusion.

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Jakarta, 9 February 2021
**KOMITE NASIONAL
KESELAMATAN TRANSPORTASI
CHAIRMAN**



SOERJANTO TJAHHONO

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ABBREVIATIONS AND DEFINITIONS

| | |
|----------|--|
| A/T | : Autothrottle |
| ADI | : Attitude Director Indicator |
| ADS-B | : Automatic Dependent Surveillance – Broadcast |
| AIP | : Aeronautical Information Publication |
| ALERFA | : Alert Phase |
| AML | : Aircraft Maintenance Log |
| AMM | : Aircraft Maintenance Manual |
| AOC | : Air Operator Certificate |
| AP | : Autopilot |
| ATC | : Air Traffic Controller |
| ATO | : Approved Training Organization |
| ATPL | : Airline Transport Pilot License |
| ATS | : Air Traffic Services |
| AUPRTA | : Airplane Upset Prevention & Recovery Training Aid |
| BITE | : built-in test equipment |
| BMKG | : Bureau of Meteorology, Climatology and Geophysics (<i>Badan Meteorologi Klimatologi dan Geofisika</i>) |
| °C | : Degree Celsius |
| CASR | : Civil Aviation Safety Regulation |
| CPL | : Commercial Pilot License |
| CPL(A) | : Commercial Pilot License-Aeroplane |
| CRM | : Crew Resources Management |
| CSMU | : Crash Survivable Memory Unit |
| CVR | : Cockpit Voice Recorder |
| DAAO | : Directorate of Airworthiness and Aircraft Operations |
| DAN | : Directorate of Air Navigation |
| dBz | : Decibel relative to Z. It is a logarithmic dimensionless technical unit used in radar, mostly in weather radar, to compare the equivalent reflectivity factor (Z) of a remote object (in mm^6 per m^3) to the return of a droplet of rain with a diameter of 1 mm (1 mm^6 per m^3) |
| DETRESFA | : Distress Phase |
| DGCA | : Directorate General of Civil Aviation |
| DMI | : Deferred Maintenance Item |
| ELBA | : Emergency Locator Beacon |
| FCTM | : Flight Crew Training Manual |
| FDR | : Flight Data Recorder |
| FIM | : Fault Isolation Manual |

| | |
|---------|---|
| FL | : Flight Level |
| FMC | : Flight Management Computer |
| ICAO | : International Civil Aviation Organization |
| INCERFA | : Uncertainty Phase |
| IPC | : Illustrated Part Catalog |
| JATSC | : Jakarta Air Traffic Services Center |
| JICT | : Jakarta International Container Terminal |
| KNKT | : <i>Komite Nasional Keselamatan Transportasi</i> |
| LT | : Local Time |
| m | : Meter |
| MEL | : Minimum Equipment List |
| MHz | : Mega Hertz |
| MPL | : Multi-crew Pilot License |
| NTSB | : National Transportation Safety Board |
| OM | : Operation Manual |
| PF | : Pilot Flying |
| PIC | : Pilot in Command |
| PM | : Pilot Monitoring |
| QPM | : Quality Procedure Manual |
| QRH | : Quick Reference Handbook |
| ROV | : Remotely Operated Vehicle |
| SIC | : Second in Command |
| SID | : Standard Instrument Departure |
| SOP | : Standard Operation Procedure |
| TE | : Terminal East |
| TOGA | : Takeoff and Go Around |
| TSIB | : Transport Safety Investigation Bureau |
| ULB | : Under-water Locator Beacon |
| UPRT | : Upset Prevention and Recovery Training |
| UTC | : Universal Time Coordinated |

SYNOPSIS

On 9 January 2021, a Boeing 737-500 aircraft, registration PK-CLC, on a scheduled domestic flight, took off from Soekarno-Hatta International Airport, Jakarta, to Supadio International Airport (WIOO), Pontianak, at 0736 UTC (1436 LT).

The flight was cleared by Air Traffic Control (ATC) to depart on a Standard Instrument Departure (SID) ABASA 2D to Flight Level (FL) 290. After taking off from Runway 25R, the autopilot was engaged at altitude of 1,980 feet. The pilots subsequently requested a heading change to 075° to enable them to deviate from weather. ATC responded with clearance for heading 075° and the flight began a turn to the right. ATC then instructed the flight to stop climbing at 11,000 feet due to conflicting departure traffic from Runway 25L.

About 10,600 feet, the aircraft heading started turning to the left. About 10,900 feet, the autopilot disengaged, and the aircraft turned to the left and started its descent.

At 14:40:37 LT, the radar target of the aircraft disappeared on the ATC radar screen. Thereafter, ATC attempted to obtain information of SJY182 aircraft by calling several times, activating and calling on the emergency frequency, and asking other pilots that were flying nearby. All efforts were unsuccessful to get a response from the SJY182 pilot.

About 1455 LT, the Air Traffic Services (ATS) provider reported the occurrence to the Indonesian Search and Rescue Agency (*Badan Nasional Pencarian dan Pertolongan*/BNPP), and at 1542 LT, declared the uncertainty phase (INCERFA) of SJY182. The distress phase of SJY182 (DETRESFA) was subsequently declared at 1643 LT.

At the time of issuing this preliminary report, the memory unit of the Cockpit Voice Recorder (CVR) has not been recovered and the search is continuing.

The *Komite Nasional Keselamatan Transportasi* (KNKT) acknowledged that the safety actions taken by the Directorate General of Civil Aviation (DGCA) and Sriwijaya Air were relevant to improve safety, however there are safety issues remain to be considered. Therefore, the KNKT issued safety recommendations to address the safety issues identified in this report.

This investigation involved the participation of the National Transportation Safety Board (NTSB) of the United States of America as the State of Design and the State of Manufacture, and the Transport Safety Investigation Bureau (TSIB) of Singapore as States providing assistance. Both agencies have appointed their accredited representatives to assist in this investigation in accordance with the provisions in ICAO Annex 13.

The investigation is ongoing. Should further safety issues emerge during the course of the investigation, KNKT will bring the issues to the attention of the relevant parties and issue safety recommendation(s) as required.

1 FACTUAL INFORMATION

1.1 History of the Flight

On 9 January 2021, a Boeing 737-500 aircraft, registration PK-CLC, was being operated by PT. Sriwijaya Air on a scheduled passenger flight from Soekarno-Hatta International Airport (WIII), Jakarta¹ to Supadio International Airport (WIOO), Pontianak². The flight number was SJY182. According to the flight plan filed, the fuel endurance was 3 hours 50 minutes.

At 0736 UTC (1436 LT³) in daylight conditions, Flight SJY182 departed from Runway 25R of Jakarta. There were two pilots, four flight attendants, and 56 passengers onboard the aircraft.

At 14:36:46 LT, the SJY182 pilot contacted the Terminal East (TE) controller and was instructed “SJY182 identified on departure, via SID (Standard Instrument Departure) unrestricted climb level 290”. The instruction was read back by the pilot.

At 14:36:51 LT, the Flight Data Recorder (FDR) data recorded that the Autopilot (AP) system engaged at altitude of 1,980 feet.

At 14:38:42 LT, the FDR data recorded that as the aircraft climbed past 8,150 feet, the thrust lever of the left engine started reducing, while the thrust lever position of the right engine remained. The FDR data also recorded the left engine N1⁴ was decreasing whereas the right engine N1 remained.

At 14:38:51 LT, the SJY182 pilot requested to the TE controller for a heading change to 075° to avoid weather conditions and the TE controller approved the request.

At 14:39:01 LT, the TE controller instructed SJY182 pilot to stop their climb at 11,000 feet to avoid conflict with another aircraft with the same destination that was departing from Runway 25L. The instruction was read back by the SJY182 pilot.

At 14:39:47 LT, the FDR data recorded the aircraft's altitude was about 10,600 feet with a heading of 046° and continuously decreasing (i.e., the aircraft was turning to the left). The thrust lever of the left engine continued decreasing. The thrust lever of the right engine remained.

At 14:39:54 LT, the TE controller instructed SJY182 to climb to an altitude of 13,000 feet, and the instruction was read back by an SJY182 pilot at 14:39:59 LT. This was the last known recorded radio transmission by the flight.

1 Soekarno-Hatta International Airport (WIII), Jakarta will be named as Jakarta for the purpose of this report.

2 Supadio International Airport (WIOO), Pontianak will be named as Pontianak for the purpose of this report.

3 The 24-hours clock in Local Time (LT) is used in this report to describe the local time as specific events occurred. Local time is Universal Time Coordinated (UTC) +7 hours.

4 N1 is the speed of the engine's low pressure rotor assembly.

At 14:40:05 LT, the FDR data recorded the aircraft altitude was about 10,900 feet, which was the highest altitude recorded in the FDR before the aircraft started its descent. The AP system then disengaged at that point with a heading of 016°, the pitch angle was about 4.5° nose up, and the aircraft rolled to the left to more than 45°. The thrust lever position of the left engine continued decreasing while the right engine thrust lever remained.

At 14:40:10 LT, the FDR data recorded the autothrottle (A/T) system disengaged and the pitch angle was more than 10° nose down. About 20 seconds later the FDR stopped recording. The last aircraft coordinate recorded was 5°57'56.21" S 106°34'24.86" E

At 14:40:37 LT, the TE controller called SJY182 to request for the aircraft heading but did not receive any response from the pilot. At 14:40:48 LT, the radar target of the aircraft disappeared from the TE controller radar screen.

At 14:40:46 LT, the TE controller again called SJY182 but did not receive any response from the pilot. The TE controller then put a measurement vector on the last known position of SJY182 and advised the supervisor of the disappearance of SJY182. The supervisor then reported the occurrence to the operation manager.

The TE controller repeatedly called SJY182 several times and also asked other aircraft that flew near the last known location of SJY182 to call the SJY182. The TE controller then activated the emergency frequency of 121.5 MHz and called SJY182 on that frequency. All efforts were unsuccessful to get any responses from the SJY182 pilot.

About 1455 LT, the operation manager reported the occurrence to the Indonesian Search and Rescue Agency (*Badan Nasional Pencarian dan Pertolongan*/BNPP).

At 1542 LT, the Air Traffic Services (ATS) provider declared the uncertainty phase (INCERFA) of the SJY182. The distress phase of SJY182 (DETRESFA) was subsequently declared at 1643 LT.

1.2 Injuries to Persons

| Injuries | Flight crew | Passengers | Total in Aircraft | Others |
|--------------|-------------|------------|-------------------|----------|
| Fatal | 6 | 56 | 62 | - |
| Serious | - | - | - | - |
| Minor | - | - | - | - |
| None | - | - | - | - |
| TOTAL | 6 | 56 | 62 | - |

All occupants were Indonesian citizens.

1.3 Damage to Aircraft

The aircraft was destroyed.

1.4 Other Damage

No other damage to property and/or the environment.

1.5 Personnel Information

1.5.1 Pilot-in-Command (PIC)

Gender : Male
Age : 54 years old
Nationality : Indonesia
Marital status : Married
Date of joining company : 24 November 2014
License : Airline Transport Pilot License (ATPL)
 Date of issue : 11 August 1997
 Aircraft type rating : Boeing 737
Instrument rating validity : 30 November 2021
Medical certificate : First class
 Date of last medical : 23 July 2020
 Validity : 23 January 2021
 Medical limitation : Holder must possess glasses that correct for near vision
Last line check : 19 May 2019
Last proficiency check : 18 November 2020
Last upset recovery training : 6 May 2019

Flying experience

Total hours : 17,904 hours 12 minutes
Total on type : 9,023 hours 22 minutes
Last 90 days : 142 hours 40 minutes
Last 30 days : 53 hours 24 minutes
Last 7 days : 13 hours 6 minutes
Last 24 hours : Nil
This flight : about 4 minutes

1.5.2 Second in Command

Gender : Male
Age : 34 years old
Nationality : Indonesia
Marital status : Married
Date of joining company : 8 November 2013

| | | |
|------------------------------|---|--|
| License | : | Commercial Pilot License (CPL) |
| Date of issue | : | 23 November 2011 |
| Aircraft type rating | : | Boeing 737 |
| Instrument rating validity | : | 31 July 2021 |
| Medical certificate | : | First class |
| Date of last medical | : | 3 July 2020 |
| Validity | : | 3 January 2021 ⁵ with exemption |
| Medical limitation | : | None |
| Last line check | : | 14 February 2020 |
| Last proficiency check | : | 24 July 2020 |
| Last upset recovery training | : | 15 July 2019 |

Flying experience

| | | |
|---------------|---|------------------------|
| Total hours | : | 5,107 hours 39 minutes |
| Total on type | : | 4,957 hours 39 minutes |
| Last 90 days | : | 113 hours 44 minutes |
| Last 30 days | : | 30 hours 10 minutes |
| Last 7 days | : | 6 hours 29 minutes |
| Last 24 hours | : | Nil |
| This flight | : | about 4 minutes |

1.5.3 Flight Attendants

All flight attendants held valid Flight Attendant Certificates with rating for Boeing 737 and valid medical examination certificates.

1.5.4 Terminal East (TE) Controller

| | | |
|-------------------------|---|---|
| Gender | : | Male |
| Age | : | 34 years |
| Nationality | : | Indonesia |
| Year of joining company | : | 2013 |
| License | : | ATC |
| Type rating | : | <ul style="list-style-type: none"> • Tower Control • Approach Control Surveillance • Approach Control Procedural |
| Validity | | 30 June 2021 |

⁵ The SIC was included to have medical certificate validity exemption due to Covid-19 pandemic to the Directorate General of Civil Aviation.

| | | |
|---------------------------|---|------------------|
| Medical certificate | : | Third Class |
| Date of last medical | : | 26 June 2018 |
| Validity | : | 26 June 2022 |
| Medical limitation | : | None |
| ICAO Language Proficiency | : | Level 4 |
| Date of issue | : | 15 November 2018 |
| Validity | : | 15 November 2021 |

Working time⁶

| | | |
|---------------|---|---------------------|
| Last 7 days | : | 19 hours 10 minutes |
| Last 24 hours | : | 40 minutes |

Duty time⁷

| | | |
|---------------|---|--------------------|
| Last 7 days | : | 9 hours 40 minutes |
| Last 24 hours | : | 40 minutes |

1.6 Aircraft Information

1.6.1 General

| | | |
|-----------------------|---|--------------------------|
| Registration Mark | : | PK-CLC |
| Manufacturer | : | Boeing Company |
| State of Manufacturer | : | United States of America |
| Type/Model | : | 737-524 |
| Serial Number | : | 27323 |
| Year of Manufacture | : | 31 May 1994 |

Certificate of Airworthiness

| | | |
|-------------|---|------------------|
| Issued | : | 17 December 2020 |
| Validity | : | 16 December 2021 |
| Category | : | Transport |
| Limitations | : | None |

Certificate of Registration

| | | |
|----------------|---|--------------|
| Number | : | 3090 |
| Issued | : | 15 May 2019 |
| Validity | : | 14 May 2022 |
| Time Since New | : | 62,983 hours |

⁶ The working time is the time period when the person attends their particular working shift.

⁷ The duty time for Air Traffic Controller is the time period when the person performs their duty to provide air traffic control service.

| | |
|------------------|-----------------------------|
| Cycles Since New | : 40,383 cycles |
| Last Major Check | : C06 (on 18 March 2019) |
| Last Minor Check | : A05 (on 18 December 2020) |

1.6.2 Engines

| | |
|------------------------|---------------------|
| Manufacturer | : CFM International |
| Type/Model | : CFM56-3B1 |
| Serial Number-1 engine | : 859110 |
| Serial Number-2 engine | : 858702 |

1.6.3 Maintenance Log Examination

The Aircraft Maintenance Log (AML) recorded that the aircraft had two Deferred Maintenance Items (DMIs) related to the first officer's Mach/Airspeed Indicator and the other to autothrottle system. The details were as follows:

DMI number list 07956

On 25 December 2020 during preflight check, the engineer found the first officer's Mach/Airspeed Indicator malfunctioned. The engineer then transferred the defect into the DMI list number 07956 due to unavailability of spare part. According to the Sriwijaya Air Boeing 737 Minimum Equipment List (MEL), the item was classified as repair category C⁸.

On 4 January 2021, the first officer's Mach/Airspeed Indicator was replaced and test result was satisfied. As such, the DMI number list 07956 was closed.

DMI number list 07958

On 3 January 2021, the pilot reported that autothrottle was unserviceable. The engineer rectified the problem by cleaning the autothrottle computer's electrical connector. After re-installation, the Built-in Test Equipment (BITE) test result was good.

On 4 January 2021, the pilot reported that autothrottle was unserviceable. The engineer tried cleaning the autothrottle computer's electrical connector but the problem remained and it was transferred to DMI number list 07958.

On 5 January 2021, the engineer rectified the problem as stated in the DMI number 07958 by cleaning autothrottle Takeoff and Go Around (TOGA) switch and conducted a BITE test on the autothrottle computer. The BITE test result was good and the DMI was then closed.

⁸ According to the Sriwijaya Air Boeing 737 Minimum Equipment List (MEL), the MEL repair category C means the item must be repaired within 10 consecutive calendar-days (240 hours) excluding the day the malfunction was recorded in the Aircraft Maintenance Log (AML).

1.7 Meteorological Information

The *Badan Meteorologi Klimatologi dan Geofisika* (BMKG – Bureau of Meteorology, Climatology and Geophysics) provided enhanced infrared satellite images. The enhanced infrared satellite images at 0730 UTC (1430 LT) and 0740 UTC (1440 LT) indicated that the cloud top temperature at the accident site (red circle) was from -34°C to -21°C.

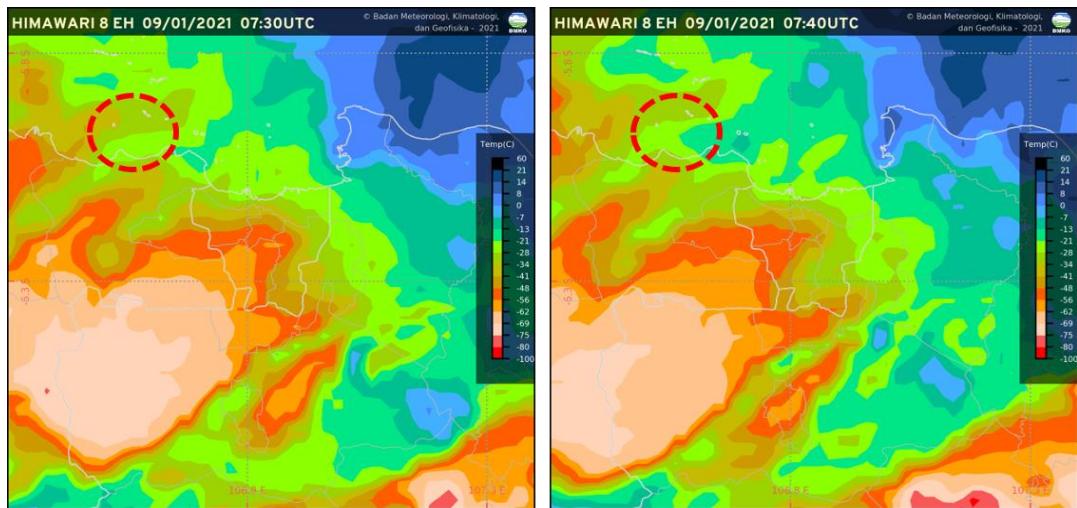


Figure 1: Enhanced infrared satellite image at 0730 UTC and 0740 UTC at accident site (red-dotted circle)

The superimposed ADS-B-based flight profile with radar weather image at 1438 LT provided by the BMKG indicated that the radar intensity level along the flight profile was not more than 25 dBZ⁹, which means that the flight path did not indicate any significant development of clouds.



Figure 2: The superimposed ADS-B-based flight profile with BMKG radar weather image at 1438 LT

⁹ Decibel relative to Z. It is a logarithmic dimensionless technical unit used in radar, mostly in weather radar, to compare the equivalent reflectivity factor (Z) of a remote object (in mm^6 per m^3) to the return of a droplet of rain with a diameter of 1 mm (1 mm^6 per m^3).

1.8 Aids to Navigation

1.8.1 ABASA 2D

Runway 25R utilized RNAV-1 Standard Instrument Departure (SID). The SID ABASA 2D given by the ATC requires aircraft to climb on heading 247° after departure from the Runway 25R. At or above 1,000 feet, the aircraft is then required to turn right to WINAR to AJUNA to NABIL to RATIH to LARAS to TOMBO to MULAN to ABASA (see Figure 22).

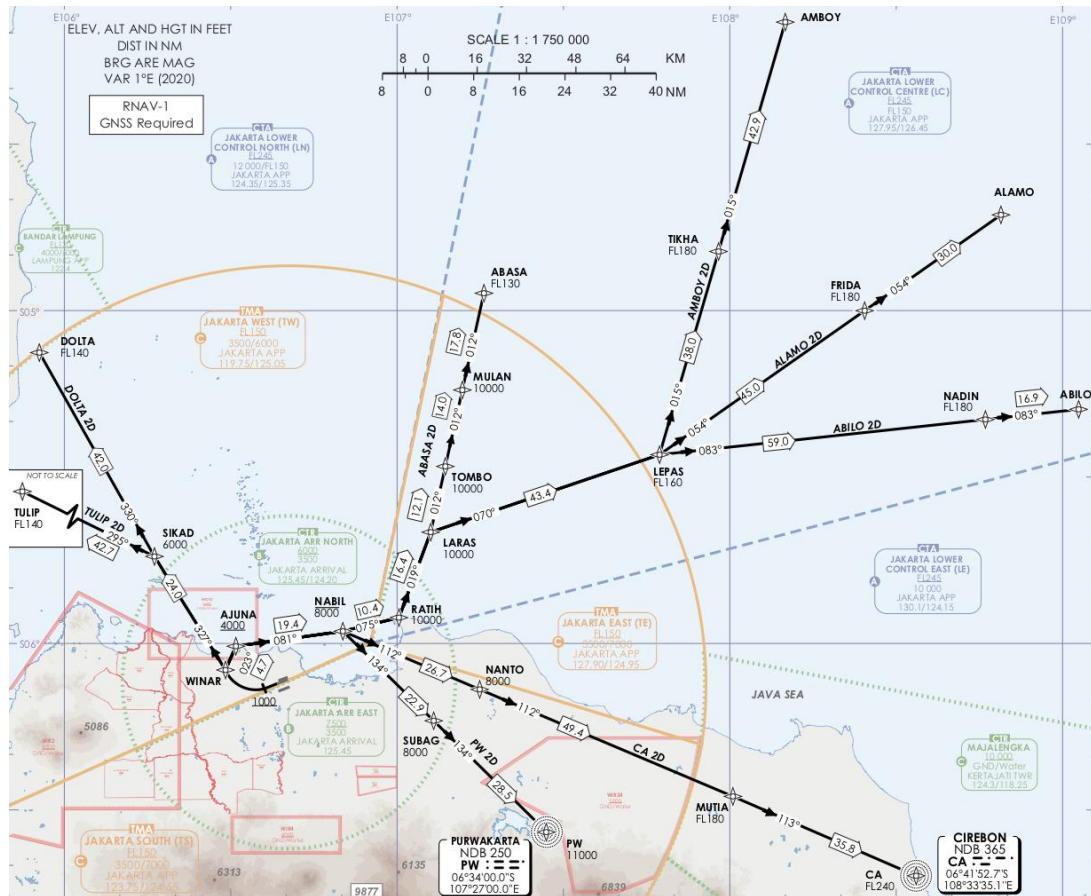


Figure 3: The RNAV-1 SID of Runway 25R (extract from AIP Volume II)

1.8.2 Automatic Dependent Surveillance – Broadcast

Automatic Dependent Surveillance – Broadcast (ADS-B) is a surveillance technology in which an aircraft determines its position via satellite navigation and periodically broadcasts it, thereby enabling it to be tracked by ground receivers.

The term “automatic” in the ADS-B means that the technology does not require flight crew or external input. The term “dependent” means its surveillance process relies on data from onboard aircraft systems to provide surveillance information to the receiver. The term “broadcast” means the originating source has no knowledge of who receives the data and there is no interrogation or two-way contact.

Several ADS-B receivers have been installed in several places including in the Jakarta Air Traffic Services Center (JATSC). The PK-CLC aircraft had ADS-B capability installed and the investigation retrieved the broadcasted aircraft data from the JATSC facility.

1.9 Communications

All communications between Jakarta air traffic controllers and the pilot were recorded by ground based automatic voice recording equipment. The quality of the recorded aircraft transmissions was good. The excerpt of communications between the pilot and the controller will be included in the final report.

1.10 Aerodrome Information

Not relevant to this accident.

1.11 Flight Recorders

1.11.1 Flight Data Recorder

The aircraft was fitted with a solid-state Flight Data Recorder (FDR) of part number 980-4700-001 and serial number 4355, manufactured by Honeywell.

On 12 January 2021, the Crash Survivable Memory Unit (CSMU) of the FDR was recovered by the search team. The CSMU was transported to the KNKT recorder facility for data downloading. The read-out was performed by KNKT investigators with the participation of the Transport Safety Investigation Bureau (TSIB) of Singapore, and National Transportation Safety Board (NTSB) of United States of America as Accredited Representatives.

The memory unit recorded 370 parameters and approximately 27 hours of aircraft flight data that contained 18 flights (including the accident flight).

The FDR information will be included in the final report.

1.11.2 Cockpit Voice Recorder

The aircraft was fitted with a FA2100 Cockpit Voice Recorder (CVR) of part number 2100-1020-00 and serial number 000286507, manufactured by L3 Technologies.

At the time of the issuance of this preliminary report, the CSMU of the CVR has not been recovered and the search is continuing.

1.12 Wreckage and Impact Information

The search team utilized a Remotely Operated Vehicle (ROV) which was equipped with an under-water camera, a side scan sonar, an Under-water Locator Beacon (ULB) pinger receiver, and a Multi Beam Echo Sounder.

The search team identified that the wreckage was about 80 meters south east from the last known aircraft position recorded by the ADS-B. The wreckage was distributed across an area of about 80 by 110 meters on the seabed at a depth of approximately 16 meters.

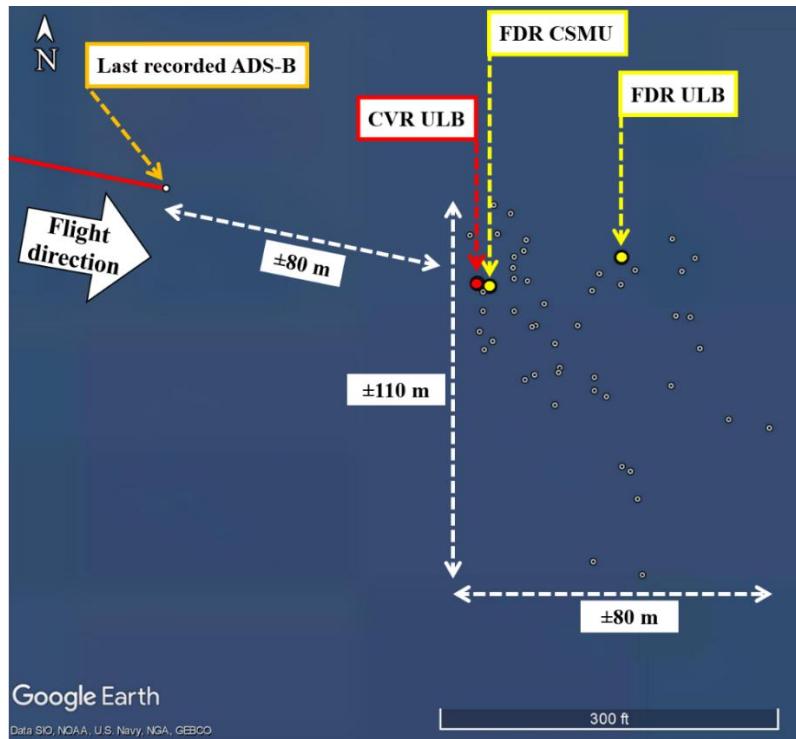


Figure 4: Location of FDR CSMU, FDR ULB and CVR ULB relative to the last ADS-B recorded data

The FDR's CSMU was found within the wreckage distribution area at coordinate $5^{\circ}57'51.00''$ S $106^{\circ}34'31.00''$ E. The ULBs were detached from both the FDR and the CVR¹⁰. The FDR's ULB was found at coordinate $5^{\circ}57'50.76''$ S $106^{\circ}34'32.10''$ E approximately 35 meters from the FDR's CSMU, and the CVR's ULB was found at coordinate $5^{\circ}57'50.98''$ S $106^{\circ}34'30.90''$ E.

Some other wreckage were recovered and transported to Jakarta International Container Terminal (JICT) for examination by the investigation team.

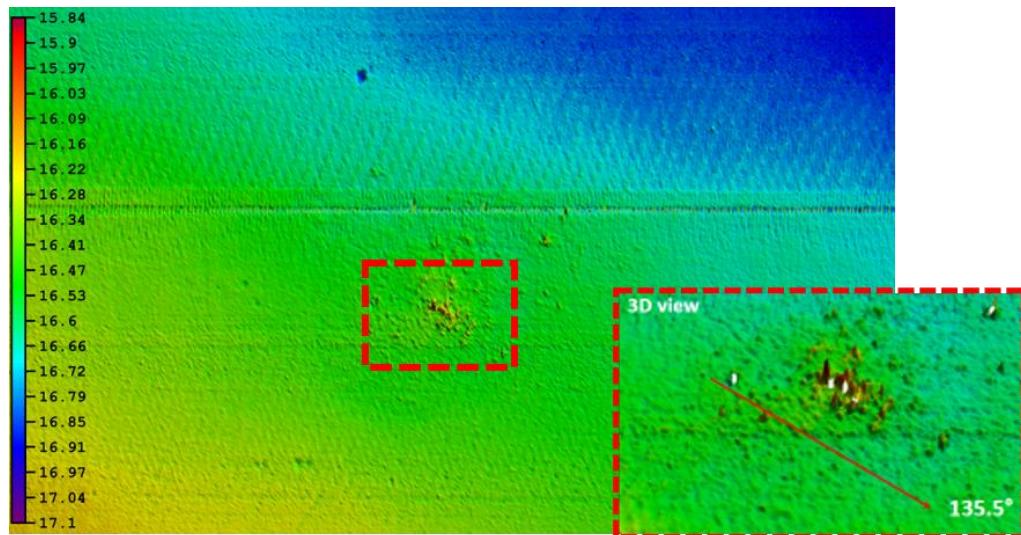


Figure 5: Scanning result from multibeam echosounder

¹⁰ Each flight recorder has a CSMU and an ULB.

1.13 Medical and Pathological Information

This information was not available at the time of the issuance of this report. Should any medical and/or pathological information be obtained in the course of this investigation that is of relevance to this investigation, it will be included in the final report.

1.14 Fire

There was no evidence of in-flight fire.

1.15 Survival Aspects

The accident was not survivable.

1.16 Tests and Research

The investigation will conduct examinations of several components including the recovered Enhanced Ground Proximity Warning System unit. The result of these examinations will be included in the final report.

1.17 Organizational and Management Information

1.17.1 Aircraft Operator

The Boeing 737-500 aircraft registered PK-CLC was owned and operated by PT. Sriwijaya Air. The aircraft operator held a valid Air Operator Certificate, number 121-035.

The Sriwijaya Air operated a total of 2 Boeing 737-900ERs, 13 Boeing 737-800s, and 6 Boeing 737-500s inclusive of the PK-CLC aircraft.

1.17.1.1 Upset Recovery Procedure

The Sriwijaya Air Boeing 737 Quick Reference Handbook (QRH), page MAN.1.7, described the upset recovery procedure as follows:

Historically, an upset has been defined as unintentionally exceeding any one or more of the following conditions:

- pitch attitude greater than 25° nose up*
- pitch attitude greater than 10° nose down*
- bank angle greater than 45°*
- less than the above parameters but flying at an airspeed inappropriate for the conditions.*

An upset condition is now considered any time an airplane is diverting from the intended airplane state. An airplane upset can involve pitch or roll angle deviations as well as inappropriate airspeeds for the conditions.

The following actions represent a logical progression for recovering the airplane. The sequence of actions is for guidance only and represents a series of options to be considered and used dependent on the situation. Not all actions may be needed once recovery is under way. If needed, use minimal pitch trim during initial recovery. Consider careful use of rudder to aid roll control only if roll control is ineffective and the airplane is not stalled.

These actions assume that the airplane is not stalled. A stall condition can exist at any attitude and can be recognized by one or more of the following:

- *Stick shaker*
- *Buffet that can be heavy at times*
- *Lack of pitch authority*
- *Lack of roll control*
- *Inability to stop a descent.*

If the airplane is stalled, first recover from the stall by applying and maintaining nose down elevator until stall recovery is complete and stick shaker stops.

• • •

Nose Low Recovery

| Pilot Flying | Pilot Monitoring |
|--|--|
| | <i>Recognize and confirm the developing situation</i> |
| <ul style="list-style-type: none"> • <i>Disengage autopilot</i> • <i>Disengage autothrottle</i> <p><i>Recover:</i></p> <ul style="list-style-type: none"> • <i>Recover from stall, if needed</i> • <i>Roll in the shortest direction to wings level. If bank angle is more than 90 degrees, unload and roll. *</i> <p><i>Complete the recovery:</i></p> <ul style="list-style-type: none"> • <i>Apply nose up elevator</i> • <i>Apply nose up trim, if needed</i> • <i>Adjust thrust and drag, if needed.</i> | <ul style="list-style-type: none"> • <i>Call out attitude, airspeed and altitude throughout the recovery</i> • <i>Verify all needed actions have been done and call out any continued deviation.</i> |

WARNING: * Excessive use of pitch trim or rudder can aggravate an upset, result in loss of control, or result in high structural loads.

1.17.1.2 Upset Recovery Training

The Sriwijaya Operation Manual Part D (OM-D), subchapter 4.3, described that the upset recovery training is included as part of the mandatory training program which required recurrency of every 24 months.

In the OM-D subchapter 4.13.3, the curriculum of the proficiency check is as follows:

| CURRICULUM SEGMENT | DELIVERY METHODS | FACILITY | DURATION | DAYS |
|--------------------------------|-------------------|-------------|------------------|----------|
| FLIGHT TRAINING | | | | |
| <i>Pilot Proficiency Check</i> | <i>Check Ride</i> | <i>FES*</i> | <i>1 Session</i> | <i>1</i> |

*FFS: full flight simulator

The OM-D subchapter 4.13.4, described that upset recovery maneuver is one of the training modules that had to be conducted during proficiency check. In the OM-D subchapter 4.13, the proficiency check is described as follows:

Sriwijaya Air may not use any person nor may any person serve as a required pilot unless that person has satisfactorily completed a proficiency check in approved airplane simulator within the preceding 6 calendar months in which he

satisfactorily performs the duties and responsibilities, and must be carried out in that type of aircraft he is to fly.

Pilot proficiency check is renewed within the last 60 days of its validity period, such check is deemed to have taken place on the last day of the validity period.

The Sriwijaya Air Boeing 737 CL Flight Crew Training Manual (FCTM), page 7.3.3, described upset recovery as follow:

For detailed information regarding the nature of upsets, aerodynamic principles, recommended training and other related information, refer to the Airplane Upset Prevention & Recovery Training Aid (AUPRTA) available through your operator and on the ICAO website.

...

The latest revision of AUPRTA concludes that an upset condition exists any time that an airplane is deviating from the intended airplane state. The AUPRTA has been updated to emphasize the importance of recognition and avoidance of situations that can lead to airplane upsets and to improve a pilot's ability to recover control of an airplane that deviates from the intended airplane state. An airplane upset can involve pitch or roll angle deviations as well as inappropriate airspeeds for the conditions.

With the focus on upset recognition and avoidance, pilots should understand how to operate the airplane throughout the entire operational flight envelope. Pilots should have practical knowledge of and demonstrate proficiency in airplane performance and handling characteristics.

Upset prevention and recovery training should emphasize the entire operational flight envelope to develop pilot awareness and handling skills in both manual and automated flight.

Upset Recovery Maneuvers

If an upset situation is recognized, immediately accomplish the Upset Recovery maneuver found in the non-normal maneuvers section in the QRH.

It is possible to consolidate upset recovery maneuvers into two basic scenarios, nose high and nose low, and to acknowledge the potential for high bank angles in each scenario. Recognizing and confirming the upset, reducing automation, and completing the recovery are included in the Upset Recovery maneuvers in the QRH. The maneuvers provide a logical progression for recovering the airplane.

To recognize and confirm the situation the crew must assess the airplane attitude, airspeed, altitude and trend information through instrument crosscheck.

The ADI¹¹ should be used as the primary reference in assessing airplane attitude. The pitch scales and color coding above/below the horizon (blue/brown) should be used when making the pitch assessment.

For any pitch attitude, the bank pointer stays perpendicular to the horizon. When completing the upset recovery maneuver, roll the shortest direction to wings level (toward the bank pointer).

11 Attitude Director Indicator.

Though flight crews in line operation rarely, if ever, encounter an upset situation, understanding how to apply aerodynamic fundamentals in such a situation helps them control the airplane. Several techniques are available for recovering from an upset. In most situations, if a technique is effective, it is not recommended that pilots use additional techniques. Several of these techniques are discussed in the example scenarios below:

- stall recovery
- nose high, wings level
- nose high, high bank angles
- nose low, wings level
- nose low, high bank angles
- high bank angles

Note: Higher than normal control forces may be required to control the airplane attitude when recovering from upset situations. Be prepared to use a firm and continuous force on the control column and control wheel to complete the recovery.

...

Nose Low, High Bank Angles

The nose low, high angle of bank upset requires prompt action by the pilot as altitude is rapidly being exchanged for airspeed. Even if the airplane is at a high enough altitude that ground impact is not an immediate concern, airspeed can rapidly increase beyond airplane design limits. Simultaneous application of roll and adjustment of thrust may be necessary. It may be necessary to apply nose-down elevator to limit the amount of lift, which will be acting toward the ground if the bank angle exceeds 90°. This also reduces wing angle of attack to improve roll capability. Full aileron and spoiler input should be used if necessary to smoothly establish a recovery roll rate toward the nearest horizon. It is important to not increase g force or use nose-up elevator or stabilizer until approaching wings level. The pilot should also extend the speedbrakes as needed.

High Bank Angles

If the airplane is not in “zero-angle-of-bank” flight, lift created by the wings is not being fully applied against gravity, and more than 1 g is required for level flight. At bank angles greater than 67°, level flight cannot be maintained within AFM load factor limits. In high bank angle increasing airspeed situations, the primary objective is to maneuver the lift of the airplane to directly oppose the force of gravity by rolling in the shortest direction to wings level. Applying nose-up elevator at bank angles above 60° causes no appreciable change in pitch attitude and may exceed normal structure load limits as well as the wing angle of attack for stall. The closer the lift vector is to vertical (wings level), the more effective the applied g is in recovering the airplane.

A smooth application of up to full lateral control should provide enough roll control power to establish a very positive recovery roll rate. If full roll control application is not satisfactory, it may even be necessary to apply some rudder in the direction of the desired roll.

Only a small amount of rudder is needed. Too much rudder applied too quickly or held too long may result in loss of lateral and directional control or structural failure.

The Sriwijaya Air has developed a training aid document for upset recovery training. The document described the training preparation guidelines for aircraft upset recovery in a variety of situations, including recovering an aircraft in a nose low situation.

| UPSET RECOVERY | | |
|---|---|--|
| PF | PM | REMARKS |
| <i>Recognize and confirm the situation</i> | | |
| NOSE LOW RECOVERY | | |
| | <ul style="list-style-type: none"> ▶ Call "UPSET BROWN" ▶ Inform ATC: "MAY DAY 3X, SJY ___ UPSET" | Note: The term Nose Low is replaced by "Upset Brown" |
| <ul style="list-style-type: none"> ▶ Disconnect autopilot and autothrottle ▶ Recover from stall, if required ▶ * Roll in shortest direction to wings level (unload and roll if bank angle is more than 90 degrees) ▶ Recover to level flight: <ul style="list-style-type: none"> ✓ Apply nose up elevator ✓ *Apply nose up trim, if required ▶ Adjust thrust and drag as required (Thrust Lever and/or speedbrakes) | <ul style="list-style-type: none"> ▶ Call out attitude, airspeed and altitude throughout the recovery ✓ Verify all required actions have been completed and call out any omissions. | If captured into High Speed Stall; keep stick shaker until reaching horizon and keep pitch at horizon WARNING: * Excessive use of pitch trim or rudder may aggravate an upset situation or may result in loss of control and/or high structural loads. |
| <i>Complete the recovery</i> | | |
| <ul style="list-style-type: none"> ▶ When approaching the horizon, roll to wings level ▶ Check airspeed and adjust thrust ▶ Establish pitch attitude. | | |
| <i>When Upset is recovered check MSA</i> | | |
| <ul style="list-style-type: none"> ▶ Return to initial altitude or MSA as required ▶ Call "SET MCP ALTITUDE" ▶ Call "CYCLE FLIGHT DIRECTOR" ▶ Engaged A/P and A/T, reset speed. | <ul style="list-style-type: none"> ▶ Call " MSA IS ___ FEET". ▶ Inform ATC: "SJ ___ REQUEST MAINTAIN/CLIMB/DESCEND TO FL ___ / ___ FEET". | |
| <i>Post recovery</i> | | |
| <ul style="list-style-type: none"> ▶ Assess: <ul style="list-style-type: none"> ✓ Aircraft condition ✓ crew and passenger condition ▶ Make a decision and inform: <ul style="list-style-type: none"> ✓ ATC ✓ Cabin crew ✓ Passengers ✓ Company | | |

Figure 6: Training preparation guideline for upset recovery – nose low

1.17.2 Air Traffic Services Provider

The *Perusahaan Umum Lembaga Penyelenggara Pelayanan Navigasi Penerbangan Indonesia* (AirNav Indonesia) is the ATS provider within Indonesia. The ATS in Jakarta is provided by AirNav Indonesia branch office located at the Jakarta Air Traffic Service Center (JATSC) which held a valid ATS provider certificate. The services provided were aerodrome control, approach control, aeronautical communications, and flight information services.

The approach control services for SJY182 flight were provided by the Terminal East controller utilizing surveillance control (radar service).

1.17.2.1 Procedure of Aircraft Lost Contact

The JATSC Standard Operation Procedure (SOP) for Approach Control Services subchapter 6.2.1 contained guidance in declaring an aircraft, which was suspected or deemed to be in an emergency situation, in the event that the pilot of the aircraft could not be contacted or a loss of communication with the aircraft. The subchapter 6.2.2 described the different states of emergency as follows:

- a. Uncertainty Phase (INCERFA)
 - i. No information has been received from an aircraft within a period of thirty minutes or since the first attempt to establish communication with such aircraft;
 - ii. An aircraft fails or has not arrived within thirty minutes of the estimated time of arrival.
- b. Alert Phase (ALERFA)
 - i. Subsequent attempts to establish communication with the aircraft and enquiries with other relevant sources have failed to reveal any news of the aircraft;
 - ii. Information has been received which indicates that the aircraft has experienced system malfunction, but not to the extent that a forced landing is likely;
 - iii. An aircraft is known or believed to be the subject of unlawful interference;
 - iv. An aircraft has been cleared to land but fails or have not land within five minutes of the estimated time of landing, and that communication has not been re-established with the aircraft.
- c. Distress Phase (DETRESFA)
 - i. Further unsuccessful attempts to establish communication with the aircraft and unsuccessful enquiries with other sources point to the probability that the aircraft is in distress;
 - ii. The fuel on board is considered to be exhausted, or to be insufficient to enable the aircraft to reach the destination or alternate destination;
 - iii. When information is received which indicates that the aircraft has experienced system malfunction to the extent that a forced landing is likely;
 - iv. Information is received or it is reasonably certain that the aircraft is about to make or has made a forced landing, except when there is reasonable certainty that the aircraft and its occupants are not threatened or in imminent danger and do not require immediate assistance.

The subchapter 6.2.3.2 described the procedures to be followed in handling an emergency:

- Immediately report the situation to the supervisor.
- Obtain from the operator or the flight crew information that may be relevant such as: number of persons on board, amount of fuel remaining, possible presence of hazardous materials and the nature thereof.
- Notify the appropriate ATS units and authorities.
- Inform all aircraft who operate near the emergency aircraft.
- Instruct all other aircraft to fly near the location of emergency aircraft and relay controller instruction if the emergency aircraft is unable to receive the instruction and to monitor the Emergency Locator Beacon-Aircraft (ELBA).

According to the subchapter 6.2.7, the ATS personnel can escalate the emergency phase on receiving information that increase the likelihood of the emergency condition, and coordinate with the Search and Rescue Agency in the escalation of the condition.

1.17.3 Civil Aviation Authority in Indonesia

The safety oversight on civil aviation in Indonesia is administered by the Directorate General of Civil Aviation (DGCA) which is part of the Ministry of Transportation. The requirement standards for civil aviation safety in Indonesia are published in the Civil Aviation Safety Regulation (CASR).

The DGCA has several directorates which includes

- the Directorate of Airworthiness and Aircraft Operations (DAAO) that are responsible for formulating policies and standards including the regulatory oversight of the civil aircraft operators; and
- the Directorate of Air Navigation (DAN) that are responsible for formulating policies and standards including the regulatory oversight of the ATS providers and aviation meteorological providers.

1.17.3.1 Upset Prevention and Recovery Training Standard

The CASR Part 121 subpart 121.404 requires aircraft operators to have several training components which included initial and recurrent for Aircraft Flight Training. The detail content of the “Aircraft Flight Training” component in the CASR Part 121 Appendix C included upset recovery training that may be accomplished in an aircraft or aircraft type simulator.

The CASR Part 121 Appendix C also required recurrent training for the “Aircraft Flight Training” component to be conducted every 12 months.

In 2018, the DGCA published a safety circular number *SE.003 Tahun 2018* that required aircraft operators to conduct upset prevention recovery training as follows:

The Operator shall ensure flight crew members complete training in procedures for aircraft upset recovery during Initial ground training and subsequently during recurrent training either once every 36 months or, if applicable, in accordance with the continuing qualification schedule as defined in the Operator's Advanced Qualification Program.

Note: Training is applicable to all pilot crew members and typically addresses pilot flying (PF) and pilot monitoring (PM) duties.

Aircraft upset recovery training typically includes:

- *Upset prevention;*
- *Factors leading to an upset or loss of control situation;*
- *Upset situation Identification;*
- *Recovery techniques;*
- *Emphasis on aerodynamic factors present during the upset and the recovery.*

Acceptable means of ground training may include video presentation(s), verbal instruction and/or group discussion.

The investigation was unable to find procedures pertaining to the delivery of upset prevention and recovery training, and guidance from the DGCA to aircraft operators and/or approved training organizations (ATOs) to enable and support the implementation of effective upset prevention and recovery training.

1.17.3.2 Notification of Rescue Coordination Centers Standard

The Civil Aviation Safety Regulation Part 170 subpart 5.2 described the different states of emergency as follows:

a. Uncertainty phase, when:

- 1) air traffic services unit has not received communication from an aircraft within a period of thirty minutes after the time a communication should have been received, or from the time an unsuccessful attempt to establish communication with such aircraft was first made;
- 2) an aircraft fails to arrive within thirty minutes of the estimated time of arrival last notified to or estimated by air traffic services unit, except when no doubt exists as to the safety of the aircraft and its occupants.

b. Alert phase, when:

- 1) following the uncertainty phase, subsequent attempts by air traffic services unit to establish communication with the aircraft or inquiries to other relevant sources have failed to reveal any news of the aircraft;
- 2) an aircraft has been cleared to land and fails to land within five minutes of the estimated time of landing and communication has not been re-established with the aircraft;
- 3) air traffic services unit has been received information which indicates that the operating efficiency of the aircraft has been impaired, but not to the extent that a forced landing is likely, except when evidence exists that would allay apprehension as to the safety of the aircraft;
- 4) air traffic services unit has received information and believed the aircraft is to be the subject of unlawful interference.

c. Distress phase when:

- 1) air traffic services unit has unsuccessful attempts to establish communication with the aircraft and more widespread unsuccessful inquiries point to the probability that the aircraft is in distress;

- 2) air traffic services unit has received information that the fuel on board is considered to be exhausted, or to be insufficient to enable the aircraft to reach the destination;
- 3) air traffic services unit is received information which indicates that the operating efficiency of the aircraft has been impaired to the extent that a forced landing is likely;
- 4) air traffic services unit is received information that the aircraft has made a forced landing, and the aircraft and its occupants are not threatened by grave and imminent danger and do not require immediate assistance.

The subpart 5.2 also described that the notification to the rescue coordination center must contain the information as follows:

- a. the phases/states of the emergency (INCERFA, ALERFA or DETRESFA);
- b. agency and person calling;
- c. nature of the emergency;
- d. significant information from the flight plan;
- e. unit which made last contact, time and means used;
- f. last position report and how determined;
- g. color and distinctive marks of aircraft;
- h. dangerous goods carried as cargo;
- i. any action taken by reporting office; and
- j. other pertinent remarks.

1.17.4 ICAO Standards and Recommended Practices

1.17.4.1 Upset Prevention and Recovery

The ICAO Annex 6 Part I (International Commercial Air Transport – Aeroplanes) subchapter 9.3 required aircraft operators to establish and maintain a ground and flight training program, approved by the civil aviation authority, which included upset prevention and recovery training (UPRT).

The ICAO Document 9868 (Procedure for Air Navigation Services – Training) provided procedures in the delivery of UPRT for aeroplane pilots. This was supported by the ICAO Document 10011 (Manual on Aeroplane Upset Prevention and Recovery Training), which provided guidance to civil aviation authorities, aircraft operators and approved training organizations (ATOs) for instituting best practices into the UPRT.

The ICAO Document 10011 described that the UPRT should focus to the following areas:

- a. heightened awareness – of the potential threats from events, conditions or situations;*
- b. effective avoidance – at early indication of a potential upset-causing condition; and*
- c. effective and timely recovery – from an upset to restore the aeroplane to safe flight parameters.*



Prevention

The ICAO Document 10011 subchapter 2.1.2 described the following:

Effective UPRT programme development and supporting regulatory frameworks require an integrated comprehensive approach to ensure standardization in the levels of knowledge and skill sets within the pilot community.

This integration effort should comprise the following UPRT components:

- a) academic training — designed to equip pilots with the knowledge and awareness needed to understand the threats to safe flight and the employment of mitigating strategies; and*
- b) practical training — designed to equip pilots with the required skill sets to effectively employ upset avoidance strategies and, when necessary, effectively recover the aeroplane to the originally intended flight path. The practical training component is further broken down into two distinct subcomponents involving:*
 - 1) on-aeroplane training — during CPL(A)¹² or MPL¹³ training in suitably capable light aeroplanes to be conducted by appropriately qualified instructors to develop the knowledge, awareness and experience of aeroplane upsets and unusual attitudes, and how to effectively analyse the event and then apply correct recovery techniques; and*
 - 2) FSTD training — on specific or generic aeroplane types to build on knowledge and experience, and apply these to the multi-crew crew resource management (CRM) environment, at all stages of flight, and in representative conditions, with appropriate aeroplane and system performance, functionality and response. Once again, this instruction should only be provided by appropriately qualified instructors.*

ICAO also provided Airplane Upset Prevention and Recovery Training Aid (AUPRTA), available on the ICAO website, as an effort to increase the ability of pilots to recognize and avoid situations that can lead to aircraft upsets, and to improve their ability to recover control of an aircraft that diverges from a pilot's desired aeroplane state.

1.17.4.2 Notifications to Rescue Coordination Centers

The standards on notification to rescue coordination center are described in the ICAO Annex 11 Standard 5.2 as follows:

5.2.1 Without prejudice to any other circumstances that may render such notification advisable, air traffic services units shall, except as prescribed in 5.5.1, notify rescue coordination centres immediately an aircraft is considered to be in a state of emergency in accordance with the following:

c) Uncertainty phase when:

- 1) no communication has been received from an aircraft within a period of thirty minutes after the time a communication should have been received, or from the time an unsuccessful attempt to establish communication with such aircraft was first made, whichever is the earlier, or when*

¹² Commercial Pilot License – Aeroplane (CPL-A).

¹³ Multi-crew Pilot License.

- 2) an aircraft fails to arrive within thirty minutes of the estimated time of arrival last notified to or estimated by air traffic services units, whichever is the later,

except when no doubt exists as to the safety of the aircraft and its occupants.

d) Alert phase when:

- 1) following the uncertainty phase, subsequent attempts to establish communication with the aircraft or inquiries to other relevant sources have failed to reveal any news of the aircraft, or when

- 2) an aircraft has been cleared to land and fails to land within five minutes of the estimated time of landing and communication has not been re-established with the aircraft, or when

- 3) information has been received which indicates that the operating efficiency of the aircraft has been impaired, but not to the extent that a forced landing is likely,

except when evidence exists that would allay apprehension as to the safety of the aircraft and its occupants, or when

- 4) an aircraft is known or believed to be the subject of unlawful interference.

e) Distress phase when:

- 1) following the alert phase, further unsuccessful attempts to establish communication with the aircraft and more widespread unsuccessful inquiries point to the probability that the aircraft is in distress, or when

- 2) the fuel on board is considered to be exhausted, or to be insufficient to enable the aircraft to reach safety, or when

- 3) information is received which indicates that the operating efficiency of the aircraft has been impaired to the extent that a forced landing is likely, or when

- 4) information is received or it is reasonably certain that the aircraft is about to make or has made a forced landing,

except when there is reasonable certainty that the aircraft and its occupants are not threatened by grave and imminent danger and do not require immediate assistance.

1.18 Additional Information

The investigation is ongoing and will continue to focus on, but not limited to the following:

- Continuing underwater search for the Crash Survivable Memory Unit (CSMU) of the CVR;
- Understanding the cause of the split thrust levers;
- Reviewing the history of the autothrottle system serviceability and maintenance records;
- Reviewing the pilot's performance and their training on upset prevention and recovery;
- Reviewing operations – human factors issue in this occurrence;
- Reviewing organizational issues in this occurrence.

Should further safety issues emerge during the course of the investigation, KNKT will bring the issues to the attention of the relevant parties and issue safety recommendation(s) as required.

1.19 Useful or Effective Investigation Techniques

The investigation was conducted in accordance with the KNKT approved policies and procedures, and in accordance with the standards and recommended practices of ICAO Annex 13 to the Chicago Convention.

2 FINDINGS

The findings are statements of all significant conditions, events or circumstances in the accident sequence. The findings are significant steps in the accident sequence, but they are not always causal, or indicate deficiencies. Some findings point out the conditions that pre-existed the accident sequence, but they are usually essential to the understanding of the occurrence, usually in chronological order.

1. The pilots and the flight attendants held valid licenses and medical certificates.
2. The air traffic controller held valid license and medical certificate.
3. The aircraft had valid Certificate of Airworthiness (C of A) and Certificate of Registration (C of R).
4. At 0736 UTC (1436 LT) in daylight conditions, flight SJY182 departed from Runway 25R of Jakarta.
5. The Flight Data Recorder (FDR) data recorded the Autopilot (AP) system engaged at altitude of 1,980 feet.
6. After the aircraft climbed past 8,150 feet, the thrust lever position of the left engine started reducing, while the thrust lever position of the right engine remained. The FDR data also recorded the left engine (N1) was decreasing whereas the right engine N1 remained.
7. The SJY182 pilot requested to the Terminal East (TE) controller for a heading change to 075° to avoid weather conditions and was approved. The TE controller predicted the heading change would make the SJY182 conflicted with another aircraft that was departing from Runway 25L to the same destination. Therefore, the TE controller instructed the SJY182 pilot to stop climbing at 11,000 feet.
8. The FDR data recorded that when the aircraft's altitude was about 10,600 feet the aircraft began turning to the left. The thrust lever position of the left engine continued decreasing while the thrust lever position of the right engine remained.
9. At 14:39:54 LT, the TE controller instructed SJY182 to climb to an altitude of 13,000 feet, and the instruction was read back by an SJY182 pilot at 14:39:59 LT. This was the last known recorded radio transmission by the flight.
10. The highest aircraft altitude recorded in the FDR was about 10,900 feet, thereafter the aircraft started its descent. The AP system then disengaged with a recorded heading of 016° , the pitch angle was 4.5° nose up, and the aircraft continued to roll to the left to more than 45° . The thrust lever position of the left engine continued decreasing while the right engine thrust lever remained.
11. About 5 seconds after the aircraft started its descent, the FDR data recorded the autothrottle (A/T) system disengaged and the pitch angle was more than 10° nose down.

12. At 14:40:48 LT, the radar target of the aircraft disappeared on the TE controller radar screen. Thereafter, the TE controller attempted to obtain information of SJY182 aircraft by calling the flight several times, activating the emergency frequency and calling SJY182 on that frequency. The TE controller also asked other pilots that were flying nearby to attempt contact with the flight. All efforts were unsuccessful to get any response from the SJY182 pilot.
13. About 1455 LT, the Air Traffic Services (ATS) provider reported the occurrence to the Indonesian Search and Rescue Agency (*Badan Nasional Pencarian dan Pertolongan*/BNPP), and at 1542 LT, declared the uncertainty phase (INCERFA) of the SJY182. The distress phase of SJY182 (DETRESFA) was subsequently declared at 1643 LT.
14. The search team identified that the wreckage was about 80 meters south east from the last known aircraft position recorded by the ADS-B. The wreckage was distributed across an area of about 80 by 110 meters on the seabed at a depth of approximately 16 meters.
15. The ATS in Jakarta is provided by AirNav Indonesia branch office Jakarta Air Traffic Service Center (JATSC) which held a valid ATS provider certificate.
16. The JATSC Standard Operation Procedure (SOP) for Approach Control Services contained guidance in declaring an aircraft which was suspected or deemed to be in an emergency situation in the event that the pilot of the aircraft could not be contacted or a loss of communication with the aircraft.
17. The JATSC SOP also mentioned several states of emergency that are in accordance with the requirement standard in Civil Aviation Safety Regulation (CASR) Part 170.
18. The determination of the states of emergency in the CASR Part 170 was adopted from ICAO Annex 11 subchapter 5.2 without including the alternative conjunction (or) on each states of the emergency. This was not in accordance with the standard described in the ICAO Annex 11.
19. The Aircraft Maintenance Log (AML) recorded that the aircraft had two Deferred Maintenance Item (DMIs) related to first officer's Mach/Airspeed Indicator and the autothrottle system which were entered on 25 December 2020 and 4 January 2021 respectively. The first officer's Mach/Airspeed Indicator was replaced and DMI closed on 4 January 2021. The autothrottle system TOGA switch was cleaned and the DMI was closed on 5 January 2021.
20. After 5 January 2021 until the day of the accident, there was no record of DMI in the AML.
21. The Boeing 737-500 aircraft registered PK-CLC was owned and operated by PT. Sriwijaya Air. The aircraft operator held a valid Air Operator Certificate, number 121-035.
22. According to the Sriwijaya Air Boeing 737 Quick Reference Handbook (QRH), an upset condition had been defined as unintentionally exceeding any one or more of the following conditions: pitch attitude greater than 25° nose up, pitch attitude greater than 10° nose down, bank angle greater than 45°, less than the above parameters but flying at an airspeed inappropriate for the conditions.

23. The Sriwijaya Operation Manual Part D (OM-D) described that upset recovery training was included as mandatory training program, which was required for recurrency within 24 months, and was also included as one of the training modules that had to be conducted during proficiency check.
24. Sriwijaya Air developed the Training Aid document for upset recovery training. The document described training preparation guidelines for recovery of upset condition, including nose low recovery.
25. The Sriwijaya Air Boeing 737 CL Flight Crew Training Manual (FCTM) contained training material for upset recovery.
26. The CASR Part 121 required aircraft operator to have initial and recurrent for Aircraft Flight Training which included upset recovery training that might be accomplished in an aircraft or aircraft type simulator, as described in the Appendix C. The published CASR Part 121 by DGCA required upset recovery training but did not include the requirement of upset prevention training.
27. In 2018, the DGCA published a safety circular number *SE.003 Tahun 2018* that required an aircraft operator to conduct upset prevention and recovery training (UPRT).
28. The investigation was unable to find procedures or guidelines in the delivering of UPRT from the DGCA to an aircraft operator and/or approved training organization (ATO) to enable and support the effective implementation of UPRT.
29. The ICAO Annex 6 Part I (International Commercial Air Transport – Aeroplanes) required aircraft operators to establish and maintain a ground and flight training program, approved by the civil aviation authority, which included UPRT.
30. The ICAO Doc 9868 (Procedure for Air Navigation Services – Training) provided procedures in the delivery of UPRT for aeroplane pilots. This was supported by the ICAO Doc 10011 (Manual on Aeroplane Upset Prevention and Recovery Training), which provided guidance to civil aviation authority, aircraft operator and approved training organization (ATO) for instituting best practices into the UPRT.
31. The ICAO Doc 10011 described that the UPRT should focus on the areas of heightened awareness of the potential threats from events, conditions or situations; effective avoidance at early indication; and effective and timely recovery.
32. ICAO also provided Airplane Upset Prevention & Recovery Training Aid (AUPRTA), as an effort to increase effectiveness of UPRT.

3 SAFETY ACTION

At the time of issuing this report, the *Komite Nasional Keselamatan Transportasi* (KNKT) had been informed of safety actions resulting from this occurrence.

3.1 Directorate General of Civil Aviation

On 11 January until 3 February 2021, the Directorate General of Civil Aviation (DGCA) conducted special inspection to all Boeing 737-300/400/500 air in Indonesia. The areas of the inspection were as follow:

- Airworthiness Directive (AD) compliances;
- routine and major inspection implementations;
- continuing analysis surveillance program implementation including the handling of repetitive defects;
- pilot training program implementation, including weather avoidance and upset recovery training program;
- pilot proficiency check implementation;
- flight duty time limitation and pilot recent experience;
- implementation of DGCA Circular regarding COVID-19 pandemic.

On 29 January and 4 February 2021, the DGCA initiated a discussion with aircraft operators and approved maintenance organizations related to the handling of repetitive problem.

On 28 January 2021, the DGCA initiated a discussion with aircraft operators on the implementation of upset prevention and recovery training (UPRT) program.

3.2 Sriwijaya Air

The Quality Maintenance Division of Sriwijaya Air issued a quality notice on 18 January 2021 to maintenance control center and engineers for ensuring:

- the repetitive defect handling must be conducted in accordance with the Safety Circular from the DGCA and Company Maintenance Manual;
- to follow the procedure described on the Aircraft Maintenance Manual (AMM), Fault Isolation Manual (FIM) and Illustrated Part Catalog (IPC) for troubleshooting;
- to fill the Aircraft Maintenance Log in accordance with the Quality Procedure Manual (QPM);
- to follow part robbing procedure as describe in the QPM and Aircraft Maintenance Procedure Manual (AMPM).

The Chief Pilot of Sriwijaya Air issued the following notice to pilots on 20 January 2021:

This notice reach you as a call toward the safe flight. With recent tragedy, we urge all pilots to raise awareness and keep the highest professionalism and discipline on your duty. This can be fulfilled with many guidance that we had:

- *Follow Operating Experience guidance.*

- *Review Training Aid.*
- *Awareness of aircraft position, attitude, aircraft systems by active monitoring the state of aircraft on every phase of flight.*
- *Awareness of aircraft configuration, thrust lever position/power setting and flight control system modes, anytime airplane deviate from its intended state must be corrected immediately.*
- *Cockpit crew is responsible for entering clear and accurate write-ups of any discrepancies, including any incident or anomaly observation in AML, use of FRM (737NG) and/or describe discrepancy information comprehensively.*

On 28 January 2021, the Standard, Quality, and Training Division of Sriwijaya Air included the upset recovery training as part of the training syllabus in the next Line Oriented Flight Training (LOFT) – Pilot Proficiency Check (PPC).

On 2 February 2021, the Quality and Safety Division of Sriwijaya Air issued safety recommendations to its Operation Directorate and Technical Directorate. The details of the safety recommendations could be found in the appendices of this report.

4 SAFETY RECOMMENDATIONS

The *Komite Nasional Keselamatan Transportasi* (KNKT) acknowledged the safety actions taken by Directorate General of Civil Aviation (DGCA) and Sriwijaya Air. The KNKT considered that the safety actions were relevant to improve safety, however there are still safety issues remain to be considered. Therefore, the KNKT issued safety recommendations to address safety issues identified in this report.

4.1 Directorate General of Civil Aviation

• 04.R-2021-01.01

The ICAO Annex 6 (Part I – International Commercial Air Transport – Aeroplanes) required the aircraft operators to establish and maintain upset prevention and recovery training (UPRT) program. The ICAO Doc 9868 (Procedure for Air Navigation Services – Training) provided procedures in the delivery of upset prevention and recovery training for aeroplane pilots.

The ICAO Doc 10011 (Manual on Aeroplane Upset Prevention and Recovery Training) also provided guidance to civil aviation authorities, aircraft operators and approved training organization (ATOs) for instituting best practices into the UPRT. The ICAO Doc 10011 described that the UPRT should focus on the areas of heightened awareness of the potential threats from events, conditions or situations; effective avoidance at early indication; and effective and timely recovery.

ICAO also provided Airplane Upset Prevention & Recovery Training Aid (AUPRTA), as an effort to increase effectiveness of UPRT.

The CASR Part 121 required aircraft operators to have initial and recurrent for “Aircraft Flight Training” which included upset recovery training that might be accomplished in an aircraft or aircraft type simulator, as described in the appendix C.

In 2018, the DGCA published a safety circular that required an aircraft operator to conduct upset prevention and recovery training. The requirement for upset prevention training was not been included in CASR Part 121.

The investigation was unable to find guidance from the DGCA to aircraft operator and/or approved training organization (ATO) to enable and support the implementation of effective upset prevention and recovery training.

Therefore, KNKT recommends the DGCA to include a requirement of UPRT in the CASR and to develop guidance to increase the effectiveness of UPRT.

- **04.R-2021-01.02**

The ICAO Annex 11 subchapter 5.2 described the state of emergency that requires notification to the rescue coordination center, this standard was adopted in the CASR Part 170 subpart 5.2. However, the adoption of determination of the state of emergency did not include the alternative conjunction (or), which was not in accordance with the Standard 5.2 described in the ICAO Annex 11. The absence of the conjunction may confuse the determination of the state of emergency and may delay the activation the search and rescue activity.

Therefore, KNKT recommends the DGCA to review the requirements of notification of rescue coordination center in the CASR 170 to ensure that the requirement is in accordance with the standards in ICAO Annex 11.

5 APPENDICES

5.1 Sriwijaya Air Quality Safety and Security Recommendation



| | |
|--------------|---|
| Number | : QSS / VQ /II/ 2021 / R-02 |
| Attention | : OF, OG, TQ, TM, TS |
| Date | : 2 February 2021 |
| CC | : DO, DT |
| Hazard Level | : Medium |
| Subject | : Safety Recommendation After PK-CLC Accident |

| | |
|---|--------|
| | Red |
| ● | Yellow |
| | Green |

A. Background

Recent accident involving Sriwijaya Air Flight SJ-182 and refer to initial investigation information by KNKT and internal audit process.

B. References

- Fault Reporting Manual Sriwijaya Air.
- Safety Management System Manual Sriwijaya Air.
- Operation Manual Sriwijaya Air.
- Company Maintenance Manual Sriwijaya Air.

C. Recommendations

Based on initial information revealed during investigation process of SJ-182 accident and on going internal audit, we recommend :

Operation Directorate

- To instruct all Pilot to write AML report as detail as necessary and use Fault Reporting Manual for Boeing 737NG to support Engineer rectifying and troubleshooting aircraft problem.
- Pilot shall report to Chief Pilot if any significant aircraft problem arises, and Chief Pilot should coordinate with OCC/MCC in order to help problem solving process.
- To remind all Crews to report immediately to QSS Directorate for Safety related abnormal or anomaly during flight.
- To remind all Pilots to maintain awareness especially on critical phase of flight.

Technical Directorate

- To utilize Aircraft Maintenance Management application to support maintenance management process.
- To remind all personnel to increase discipline on following Company Maintenance Manual (CMM) and Aircraft Maintenance Procedure.
- To improve coordination between Engineer with Pilot in Command (PIC) and if needed to coordinate with Chief Pilot in order to enhance problem solving process.
- To remind all Engineers to report any hazards, abnormal or anomaly conditions to QSS Directorate.

If you feel unclear or inconvenience with this message, please do not hesitate to contact us; **realize that your performance can have a positive or negative impact to the company. QUALITY-SAFETY-SECURITY STARTS WITH ME**



QUALITY, SAFETY AND SECURITY RECOMMENDATION

Sriwijaya Air Tower, Jl. Atang Sanjaya No. 21 Soekarno Hatta Airport Tangerang 15125 - Indonesia
Phone : **62-21-8063-7888**, FAX : **62-21-8063-7887**, EMAIL : qss@sriwijayaair.co.id

We encourage you to report any deviations during operation, we will keep as confidential and non-punitive manner :

- WhatsApp : +62 811-8146-681
- Email : qss@sriwijayaair.co.id
- Web-report : <https://ssms.sriwijayaair.co.id/ssms>

This QSS Recommendation issued as part of Sriwijaya Air effort to prevent similar accident to happen in the future and as part of continuous improvement to maintain customer trust of Sriwijaya Air Operations.

Best Regards,

GM Quality & Safety

If you feel unclear or inconvenience with this message, please do not hesitate to contact us; **realize that your performance can have a positive or negative impact to the company. QUALITY-SAFETY-SECURITY STARTS WITH ME**

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